

REMARKS

Reconsideration of this application is requested. Claim 39 has been rewritten in independent form. Claim 39 has not been narrowed by this amendment and has not been amended for reasons substantially related to patentability. Claims 60-64 have been added. Support for claims 60-64 is found at, for example, page 4, lines 3-6; page 6, lines 9-11 and 14; page 7, lines 7-13; page 8, lines 9-12; page 11, lines 23-29; and page 13, lines 8-15, of the specification. Claims 1-64 are pending; however, claims 1-38 and 40-59 have been withdrawn from consideration. Therefore, claims 39 and 60-64 are at issue.

Applicants gratefully acknowledge the courtesy shown by the Examiner during the interview on May 13, 2002.

The Examiner has required restriction to one of the following groups of claims under 35 U.S.C. §121:

Group I: Claims 1-38 and 59, drawn to a method of preparing cellulose ethers;

Group II: Claims 39-46, drawn to a cellulose ether; and

Group III: Claims 47-58, drawn to a cellulose floc and a method of preparing the same.

Applicants respectfully traverse this restriction requirement and request reconsideration.

A careful search of the prior art relevant to the claims of Group II would develop the prior art relevant to the claims of Groups I and III, since the product recited in the claims of Group II is made by the process recited in the claims of Groups I and III and, optionally, with the cellulose floc recited in the claims of Group III. If the product recited in

the claims of Group II are patentable, so are the methods for making it recited in the claims of Group I.

For the foregoing reasons, applicants believe that the Examiner's restriction of the claims is unwarranted and respectfully request that the Restriction be withdrawn and the claims be examined together in this application.

If the Restriction is not withdrawn, applicants respectfully request rejoinder of the claims of Group I upon the allowance of the claims of Group II.

In order to be fully responsive, applicants confirm that they have provisionally elected the claims of Group II, claims 39-46, for further prosecution.

The Examiner has also required applicants to elect a particular cellulose ether. Applicants confirm that they have elected carboxymethyl cellulose as the particular cellulose ether to be examined.

The February 12, 2002 Office Action states that claims 40-46 are not directed to the elected specie (i.e., carboxymethyl cellulose) and are therefore withdrawn from consideration. Claims 43-46, however, are directed to carboxymethyl celluloses derived from various types of pulps. For example, claim 43 recites a carboxymethyl cellulose derived from cotton linter pulp having a 1% solution viscosity of from about 60,000 to about 100,000 cP. Therefore, claims 43-46 read on the elected specie. Accordingly, applicants respectfully request that the Examiner consider claims 43-46 with claim 39.

The Old Process for Making Carboxymethyl Cellulose (CMC)

Prior to the present invention, carboxymethyl cellulose (CMC) was typically prepared by:

1. Alkalating a starting cellulose pulp; and
2. Etherifying the alkalated cellulose pulp to form the CMC.

The Invented Process

In the new process described in the present application, CMC is prepared by:

1. (NEW STEP) Mercerizing the cellulose pulp;
2. (NEW STEP) Recovering the mercerized cellulose pulp (such as by washing and/or neutralizing the cellulose pulp);
3. Alkalating the cellulose pulp; and
4. Etherifying the alkalated cellulose pulp to form the CMC.

None of the cited prior art references disclose or suggest mercerizing and recovering the cellulose pulp before alkalating and etherfying it to form CMC.

The CMC Product of the Present Invention

The CMC produced by the process of the present invention has unique rheological properties. For instance, the CMC has significantly higher viscosities than similar CMC's produced by prior art methods as shown in Tables 1-4 below.

Table 1

CMC Derived from Cotton Linter Pulp				
Example No. in the present application	Concentration of NaOH (%)	1% Solution Viscosity (cP)	Control's 1% Solution Viscosity (cP)	Percentage Change in Viscosity
1 (Never-dried) ¹	14	80095	34690	130.89%
	18	83745	34690	141.41%
7 (Never-dried)	18 (Average)	79410	21493	269.47%
7 (Re-wetted dried)	18 (Average)	43453	21493	102.17%
9 (Never-dried)	18	75190	30145	149.43%
10 (Never-dried)	18	55335	25685	115.44%
10 (Never-dried)	18	57190	13920	310.85%

¹

The 7 and 10% NaOH treated pulp contained 0% sheet cellulose II.

Table 2

CMC derived from Southern Softwood Kraft Pulp				
Example No. in the present application	Concentration of NaOH (%)	1% Solution Viscosity (cP)	Control's 1% Solution Viscosity (cP)	Percentage Change in Viscosity
2 ²	10	607	586	3.58%
	14	1268	586	116.38%
	18	1147	586	95.73%
3 (Never- dried)	7	679	550	23.45%
	10	1108	550	101.45%
	14	1365	550	148.18%
	18	1472	550	167.64%

Table 3

CMC derived from Southern Hardwood Kraft Pulp				
Example No. in the present application	Concentration of NaOH (%)	1% Solution Viscosity (cP)	Control's 1% Solution Viscosity (cP)	Percentage Change in Viscosity
5 ³	10	461	230 or 362	100.43% or 27.35%
	14	547	230 or 362	137.83% or 51.10%
	18	923	230 or 362	301.30% or 154.97%

² Table 2 indicates that the 7% NaOH treated pulp contained 0% sheet cellulose II.
³ Table 6 indicates that the 7% treated pulp contained only 1% sheet cellulose II.

Table 4

CMC derived from Northern Softwood Sulfite Pulp				
Example No. in the present application	Concentration of NaOH (%)	1 % Solution Viscosity (cP)	Control's 1 % Solution Viscosity (cP)	Percentage Change in Viscosity
4 ⁴	10	2037	898 or 1087	126.84% or 87.40%
	14	1835	898 or 1087	104.34% or 68.81%
	18	2608	898 or 1087	190.42% or 139.93%

Tables 1-4 show that CMC's produced by the process of the present invention have significantly higher viscosities than CMC's produced by prior art processes. For example, Table 1 shows that when a cotton linter pulp starting material is mercerized and recovered prior to alkalating and etherifying it, the viscosity of the CMC formed increases by at least 102%. Table 4 shows that when a sulfite pulp starting material is mercerized and recovered prior to alkalating and etherfying it, the viscosity of the CMC formed increases by at least 104%.

Prior to the present invention, CMC's having the following viscosities (as measured according to ASTM D 2196 in an aqueous solution consisting of 1% by weight of CMC) did not exist:

⁴ Table 5 indicates that the 7% treated pulp contained 0% sheet cellulose II.

CMC derived from Cotton Linter Pulp	60,000 to 80,000 cP
CMC derived from Southern Softwood Kraft Pulp	1,000 to 1,600 cP
CMC derived from Southern Hardwood Kraft Pulp	1,000 to 3,000 cP
CMC derived from Northern Softwood Sulfite Pulp	1,800 to 3,000 cP

Since the presently claimed CMC's can have significantly higher viscosities than prior art CMC's, applicants respectfully submit that they are different than prior art CMC's, and the CMC's of this invention are novel and nonobvious.

The Prior Art

Claim 39 has been rejected under 35 U.S.C. §102(b) as anticipated by Mansikkamaki (EP 879,827) (EP '827). In the Official Action, the Examiner refers to the CMC's described in Table 2 on p. 3 of EP '827. Table 2 recites 2% viscosities for CMC's prepared in the examples of EP '827.

This rejection is respectfully traversed and reconsideration is requested.

EP '827 does not disclose or suggest the process for preparing CMC's described in the present application. In particular, EP '827 does not teach mercerizing and recovering cellulose pulp before alkalating and etherifying it to form CMC. Therefore, the process of the reference does not produce CMC's which anticipate the CMC's of this patent application.

EP '827 does not indicate the type of cellulose pulp from which the CMC is derived. As shown in the tables above, the type of cellulose pulp selected as a starting material has a profound effect on the viscosity of the CMC formed. For example, CMC's derived from

cotton linter pulp had 1% viscosities of about 54,000 to 84,000 cP (Table 1), while CMC's derived from Northern Softwood Sulfite Pulp had 1% viscosities of about 1830 to 2600 cP (Table 4).

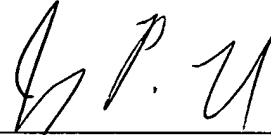
EP '827 does not state how the 2% viscosity is measured. The viscosities recited in the pending claims are for aqueous solutions containing 1% of CMC. 2% aqueous solutions of the CMC's of the present invention would have significantly higher viscosities than the 1% viscosities recited in the present application. (Please note that 1 mPas = 1 cP; The viscosities recited in EP '827 are in mPas while those in the present application are recited in cP).

The presently claimed CMC's are different from those recited in EP '827 and the cited prior art references as shown by the viscosities discussed above. For these reasons, EP '827 does not anticipate the CMC recited in claim 39.

In view of the above amendments and remarks, it is respectfully requested that the application be reconsidered and that all pending claims be allowed and the case passed to issue.

If there are any other issues remaining which the Examiner believes could be resolved through either a Supplemental Response or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned at the telephone number indicated below.

Respectfully submitted



Jay P. Lessler
Reg. No. 41,151
Attorney for Applicants

DARBY & DARBY
Post Office Box 5257
New York, NY 10150-5257
Phone (212) 527-7700

Marked-Up Claims
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For U.S. Serial No. 09/57,804
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1. A method of preparing cellulose ethers comprising the steps of:
 - (a) obtaining mercerized and recovered cellulose pulp; and
 - (b) converting the mercerized and recovered cellulose pulp into the

cellulose ethers,

wherein the mercerized cellulose pulp in step (a) was mercerized with a cellulose II mercerizing agent, and the mercerized and recovered cellulose pulp has a TAPPI 230 om-89 viscosity greater than 12 cP, when the cellulose pulp is southern softwood kraft.

2. The method of claim 1, wherein the cellulose pulp is selected from the group consisting of cotton linters pulps, hardwood cellulose pulps, softwood cellulose pulps, sulfite cellulose pulps, kraft cellulose pulps, rehydrated cellulose pulps, and any combination of any of the foregoing.

3. The method of claim 2, wherein the hardwood cellulose pulp is selected from the group consisting of southern hemisphere hardwood kraft cellulose pulps, southern hemisphere hardwood sulfite cellulose pulps, Scandinavian hardwood kraft cellulose pulps, Scandinavian hardwood sulfite cellulose pulps, northern hardwood kraft cellulose pulps (NHK), northern hardwood sulfite cellulose pulps, southern hardwood kraft cellulose pulps (SHK),

southern hardwood sulfite cellulose pulps, tropical hardwood kraft cellulose pulps, tropical hardwood sulfite cellulose pulps, and any combination of any of the foregoing.

4. The method of claim 2, wherein the softwood cellulose pulp is selected from the group consisting of southern hemisphere softwood kraft cellulose pulps, southern hemisphere softwood sulfite cellulose pulps, Scandinavian softwood kraft cellulose pulps, Scandinavian softwood sulfite cellulose pulps, southern softwood kraft cellulose pulps (SSK), northern softwood kraft cellulose pulps (NSK), southern softwood sulfite cellulose pulps (SSS), northern softwood sulfite cellulose pulps (NSS), and any combination of any of the foregoing.

5. The method of claim 2, wherein the sulfite cellulose pulp is selected from the group consisting of southern softwood sulfite cellulose pulps, northern softwood sulfite cellulose pulps, tropical hardwood sulfite cellulose pulps, and any combination of any of the foregoing.

6. The method of claim 1, wherein the cellulose pulp is cotton linters pulp.

7. The method of claim 1, wherein the cellulose pulp is a softwood sulfite cellulose pulp.

8. The method of claim 1, wherein the cellulose pulp is a never dried cellulose pulp.

9. The method of claim 1, wherein the cellulose pulp is not regenerated cellulose pulp.
10. The method of claim 1, wherein the mercerized and recovered cellulose pulp is a cellulose floc.
11. The method of claim 1, wherein step (a) comprises:
- (i) mercerizing cellulose pulp; and
 - (ii) washing, neutralizing, or neutralizing and washing the mercerized cellulose pulp.
12. The method of claim 1, wherein step (a) comprises:
- (i) mercerizing cellulose pulp; and
 - (ii) washing the mercerized cellulose pulp.
13. The method of claim 12, wherein the mercerized cellulose pulp in step (a)(ii) is washed with an aqueous solution.
14. The method of claim 13, wherein the washing step is continued until the residual water has a pH of less than about 10.
15. The method of claim 13, wherein step (a) further comprises (iii) drying the mercerized and washed, neutralized, or washed and neutralized cellulose pulp.

16. The method of claim 15, wherein the mercerized and dried cellulose pulp contains less than about 20% by weight of moisture content, based upon 100% weight of total cellulose pulp and water.

17. The method of claim 10, wherein step (a) comprises:

- (i) treating cellulose pulp to form a cellulose floc;
- (ii) mercerizing the cellulose floc; and
- (iii) washing, neutralizing, or neutralizing and washing the mercerized cellulose floc.

18. The method of claim 1, wherein the mercerized and recovered cellulose pulp is substantially free of cellulose III.

19. The method of claim 1, wherein the mercerized and recovered cellulose pulp contains less than about 3.5% by weight of mercerizing agent, based upon 100% by weight of cellulose pulp and mercerizing agent

20. The method of claim 19, wherein the mercerized and recovered cellulose pulp contains less than about 0.3% by weight of mercerizing agent, based upon 100% total weight of cellulose pulp and mercerizing agent.

21. The method of claim 20, wherein the mercerized and recovered cellulose pulp contains less than about 0.03% by weight of mercerizing agent, based upon 100% total weight of cellulose pulp and mercerizing agent.

22. The method of claim 1, wherein the mercerized and recovered cellulose pulp has an Rx value of greater than 0.57.

23. The method of claim 22, wherein the mercerized and recovered cellulose pulp has an Rx value of greater than 0.60.

24. The method of claim 23, wherein the mercerized and recovered cellulose pulp has an Rx value of greater than 0.64.

25. The method of claim 1, wherein the mercerized and recovered cellulose pulp has at least about 20% by weight of cellulose II, based upon 100% total weight of the crystalline portion of the mercerized cellulose pulp.

26. The method of claim 1, wherein the mercerized and recovered cellulose pulp has a total crystallinity of less than about 60% by weight, based on 100% weight of total cellulose pulp.

27. The method of claim 1, wherein step (b) comprises converting the mercerized cellulose pulp into the cellulose ethers via a cellulose floc intermediate.

28. The method of claim 27, wherein step (b) comprises:
- (i) treating the mercerized and recovered cellulose pulp to form a cellulose floc;
 - (ii) alkalating the cellulose floc to form an alkali cellulose; and
 - (iii) etherifying the alkali cellulose to form the cellulose ethers.
29. The method of claim 28, wherein step (b)(i) comprises grinding, dicing, or shredding the mercerized cellulose pulp to form the cellulose floc.
30. The method of claim 28, wherein step (b)(ii) comprises treating the cellulose floc with an alkalating agent.
31. The method of claim 30, wherein the alkalating agent is an alkali metal hydroxide.
32. The method of claim 28, wherein step (b)(iii) comprises reacting the alkali cellulose with an etherification agent to form the cellulose ethers.
33. The method of claim 32, wherein the etherification agent comprises sodium-mono-chloro acetate.

34. The method of claim 10, wherein step (b) comprises:

- (i) alkalating the cellulose floc to form an alkali cellulose; and
- (ii) etherifying the alkali cellulose to form the cellulose ethers.

35. The method of claim 1, wherein the cellulose ether is a carboxymethyl cellulose.

36. The method of claim 1, wherein the cellulose ether is a methyl cellulose.

37. The method of claim 1, wherein the cellulose ether is a nonionic ether.

38. The method of claim 1, wherein the cellulose ether is an ionic ether.

39. (Amended) A carboxymethyl cellulose ether prepared by [the] a method [of claim 35] comprising the steps of:

(a) obtaining mercerized and recovered cellulose pulp; and

(b) converting the mercerized and recovered cellulose pulp into

carboxymethyl cellulose, wherein the mercerized cellulose pulp in step (a) was mercerized with a cellulose II mercerizing agent, and the mercerized and recovered cellulose pulp has a TAPPI 230 om-89 viscosity greater than 12 cP, when the cellulose pulp is southern softwood kraft.

40. A methyl cellulose ether prepared by the method of claim 36.

41. A nonionic cellulose ether prepared by the method of claim 37.

42. An ionic cellulose ether prepared by the method of claim 38.

43. A cotton linter pulp derived carboxymethyl cellulose having a solution viscosity of from about 60,000 to about 100,000 cP in an aqueous solution consisting of 1% by weight of the carboxymethyl cellulose as measured according to ASTM D 2196.

44. A softwood kraft pulp derived carboxymethyl cellulose having a solution viscosity of from about 1,000 to about 1,600 cP in an aqueous solution consisting of 1% by weight of the carboxymethyl cellulose as measured according to ASTM D 2196.

45. A hardwood kraft pulp derived carboxymethyl cellulose having a solution viscosity of from about 1,000 to about 1,600 cP in an aqueous solution consisting of 1% by weight of the carboxymethyl cellulose as measured according to ASTM D 2196.

46. A wood pulp derived carboxymethyl cellulose having a solution viscosity of from about 1,800 to about 3000 cP in an aqueous solution consisting of 1% by weight of the carboxymethyl cellulose as measured according to ASTM D 2196.

47. A method of preparing cellulose floc comprising the steps of:

- (a) obtaining mercerized and recovered cellulose pulp, and
- (b) treating the mercerized pulp to form the cellulose floc,

wherein the mercerized and recovered cellulose pulp is substantially free of cellulose III, and

the mercerized cellulose pulp has a TAPPI 230 om-89 viscosity greater than 12 cP, when the cellulose pulp is southern softwood kraft.

48. The method of claim 47, wherein the cellulose pulp is selected from the group consisting of cotton linters pulps, hardwood cellulose pulps, softwood cellulose pulps, sulfite cellulose pulps, kraft cellulose pulps, rehydrated cellulose pulps, and any combination of any of the foregoing.

49. The method of claim 47, wherein the cellulose pulp is a sulfite cellulose pulp.

50. The method of claim 47, wherein step (a) comprises:

- (i) mercerizing cellulose pulp; and
- (ii) washing, neutralizing, or neutralizing and washing the mercerized cellulose pulp.

51. The method of claim 47, wherein the mercerized and recovered cellulose pulp contains less than about 3.5% by weight of mercerizing agent, based upon 100% by weight of cellulose pulp and mercerizing agent

52. The method of claim 51, wherein the mercerized and recovered cellulose pulp contains less than about 0.3% by weight of mercerizing agent, based upon 100% total weight of cellulose pulp and mercerizing agent.

53. A cellulose floc prepared by the method of claim 47.

54. A method of preparing mercerized cellulose floc comprising the steps of:

- (a) mercerizing the cellulose floc; and
- (b) recovering the mercerized cellulose floc,

wherein the mercerized and recovered cellulose floc is substantially free of cellulose III.

55. A cellulose floc prepared by the method of claim 54.

56. A cotton linters pulp derived cellulose floc having an average floc length of from 0.25 to 0.50 mm and a floc tap density according to the formula:

$$\text{Floc Tap Density}_{\text{CLP Floc}} = m * (\text{AFL})^{-0.8043}$$

wherein m ranges from 0.0755 to 0.0835 and AFL is the number average floc length of the cellulose floc.

57. A southern softwood kraft derived cellulose floc having an average floc length of from 0.25 to 0.50 mm and a floc tap density according to the formula:

$$\text{Floc Tap Density}_{\text{SSK Floc}} = m * (\text{AFL})^{-0.9676}$$

wherein m ranges from 0.0841 to 0.0925 and AFL is the number average floc length of the cellulose floc.

58. A northern softwood sulfite derived cellulose floc having an average floc length of from 0.25 to 0.50 mm and a floc tap density according to the formula:

$$\text{Floc Tap Density}_{\text{NSS Floc}} = m * (\text{AFL})^{-0.7336}$$

wherein m ranges from 0.0689 to 0.0758 and AFL is the number average floc length of the cellulose floc.

59. A method of preparing cellulose ethers comprising the steps of:

- (a) selecting a desired viscosity for the cellulose ethers;
- (b) obtaining mercerized and recovered cellulose pulp having the appropriate

viscosity for yielding cellulose ethers having the selected viscosity; and

- (c) converting the mercerized and recovered cellulose pulp to the cellulose

ethers,

wherein the mercerized and recovered cellulose pulp is substantially free of cellulose III, and the mercerized cellulose has a TAPPI 230 om-89 viscosity greater than 12 cP, when the cellulose pulp is southern softwood kraft.

60. The carboxymethyl cellulose ether of claim 39, wherein the mercerized

and recovered cellulose pulp in step (a) is obtained by (i) mercerizing cellulose pulp, (ii)

washing, neutralizing, or washing and neutralizing the mercerized cellulose pulp, and (iii)

optionally, drying the mercerized cellulose pulp.

61. A carboxymethyl cellulose ether prepared by a method comprising the

steps of:

- (a) mercerizing cellulose pulp with a cellulose II mercerizing agent;

(b) washing, neutralizing, or neutralizing and washing the mercerized cellulose pulp from step (a); and

(c) alkalating the mercerized cellulose pulp from step (b) to form an alkali cellulose; and

(d) etherifying the alkali cellulose to form the carboxymethyl cellulose, wherein the mercerized cellulose pulp formed in step (b) has a TAPPI 230 om-89 viscosity greater than 12 cP, when the cellulose pulp is southern softwood kraft.

62. The carboxymethyl cellulose ether of claim 60, wherein the cellulose pulp is a sulfite cellulose pulp.

63. A carboxymethyl cellulose ether prepared by a method comprising the steps of:

(a) mercerizing cellulose pulp with a cellulose II mercerizing agent;

(b) washing, neutralizing, or neutralizing and washing the mercerized cellulose pulp from step (a); and

(c) alkalating the mercerized cellulose pulp from step (b) to form an alkali cellulose; and

(d) etherifying the alkali cellulose to form the carboxymethyl cellulose,

wherein the mercerized cellulose pulp formed in step (b) has a TAPPI 230 om-89 viscosity greater than 12 cP when the cellulose pulp is southern softwood kraft; and

wherein the carboxymethyl cellulose has a solution viscosity in an aqueous solution consisting of 1% by weight of the carboxymethyl cellulose as measured according to ASTM D 2196 of:

- (i) from about 60,000 to about 100,000 cP, when the cellulose pulp is cotton linter pulp,
- (ii) from about 1,000 to about 1,600 cP, when the cellulose pulp is softwood kraft pulp or hardwood kraft pulp, or
- (iii) from about 1,800 to about 3,000 cP, when the cellulose pulp is wood pulp.

64. A carboxymethyl cellulose ether prepared by a method comprising the steps of:

- (a) mercerizing cellulose pulp with a cellulose II mercerizing agent to form a cellulose pulp having at least about 20% by weight of cellulose II, based upon 100% total weight of the crystallize portion of the mercerized cellulose pulp;
- (b) washing, neutralizing, or neutralizing and washing the mercerized cellulose pulp from step (a); and
- (c) alkalating the mercerized cellulose pulp from step (b) to form an alkali cellulose; and
- (d) etherifying the alkali cellulose to form the carboxymethyl cellulose,

wherein the mercerized cellulose pulp formed in step (b) has a TAPPI 230 om-
89 viscosity greater than 12 cP, when the cellulose pulp is southern softwood kraft.